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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/008,473
Filing Date: November 09, 2001
Appellant(s): ENENKEL ET AL.

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Technology Center 2100

Scott D. Paul #42,984
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 02/16/2007 appealing from the Office action mailed 01/29/2007.

(1) Real Party in Interests

A statement identifying by name the real party of interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

(9a) Claims 1-19,23-44 are rejected under 101 since the limitations recite arithmetic operations via a data signals (e.g., claim 1, line 17 and claim 23, line 14) as well as arithmetic equations/functions (e.g., claims 15 and 37 Bessel functions; claims 15-16, 37-38, error functions; claim 33, Homer' Rule).

The following paragraphs are excerpts from patentable subject matter eligibility: If the "acts" of a claimed process manipulate only numbers, abstract concepts or ideas, or signals representing any of the foregoing, the acts are not being applied to appropriate subject matter. Benson, 409 U.S. at 71-72, 175 USPQ at 676. Thus, a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process.

In practical terms, claims define nonstatutory processes if they:
– consist solely of mathematical operations without some claimed practical application (i.e., executing a "mathematical algorithm"); or
– simply manipulate abstract ideas, e.g., a bid (Schrader, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (Warmerdam, 33 F.3d at 1360, 31 USPQ2d at 1759), without some claimed practical application.

Thus, a claim that recites a computer that solely calculates a mathematical formula (see Benson) or a computer disk that solely stores a mathematical formula is not directed to the type of subject matter eligible for patent protection.

(9b) Claims 1-4, 8-10, 23, 24, 26, 30, 31,32, 41-44 are rejected under 35 U.S.C. 103 (a) as being unpatented over Bishop, titled, "Modem Control Systems Analysis & Design using MATLAB® (hereafter Bishop) in view of Kametani (US Patent 4,870,608).

Per claims 1,3,4, 23,25 26 Bishop teaches

- A machine-processing method for computing a property of a mathematically modeled (pg. 17, title) physical system (e.g., fluid flow reservoir, pg. 20)
- input data (pg. 18, 2nd paragraph, bullet point 4)
- outputting, via said machine-processing unit (pg. 18, 2nd paragraph, bullet points 3-6)

but fails to teach polynomials inside a machine-processing unit to which Kametani teaches.

Per claims 1,3,4, 23, 26 Kametani teaches

- reading, via a machine processing unit, (column 4, lines 19-31) including a value for each identified ordered coefficient of a first polynomial p(x) representing said property (column 2, lines 60-65)
- polynomial p(x) being expressed as p(x) = sum (Pj • x') where j=0 to n, a value of a quantity x, a value of a predetermined x_i, and a value of a predetermined $p(x_i)$ correspondingly paired with said predetermined x_i; (Taylor series, column 4, lines 52-66)
- building a value of &second polynomial c(x) having ordered coefficients, (column 4, equation 2) said second polynomial c(x) being expressible as: c(x) = sum ($C_k \cdot x^k$) where k=0 to (n-1) so that said first polynomial p(x) is

expressible as: $p(x)=p(xi)+\{x-xi\} \cdot c(x)$, (column 5, equation 3)

- determining, a value for each ordered coefficient (column 4, equation 2) of said second polynomial c(x) by generating ordered coefficient of said second polynomial c(x) from: $C_k = \text{sum}\,(Poo_{i+j)} \cdot x_i^j)$ where j=0 to (n-1-k); (column 4, equation 3)
- determining, a value of said second polynomial c(x) ("series of polynomials" column 2, lines 5-10) by generating a plurality of machine processing unit signals to determine: $c(x) = \text{sum}(C_k \cdot x^k)$ (column 4, equation 2) where k=0 to (n-1);
- constructing, a value of said first polynomial p(x) ("series of polynomials" column 2, lines 5-10) by generating a plurality of machine processing unit signals to determine: $p(x)=p(xi)+\{x- x_i) \cdot c(x)$; (column 5, lines 15-30) and d) value of the first polynomial p(x) ("series of polynomials" column 2, lines 5-10) said value of the first polynomial as a floating point ("series of polynomials" column 2, lines 5-10) number and the floating point (column 2, line 48) number is a digital representation (logic circuit, column 6, lines 31-54) of an arbitrary real number

Therefore, at the time of invention it would have been obvious to one of ordinary skill in the art to modify Bishop in view of Kametani to improve the cost-performance (performance/cost) attained in the addition, subtraction, and multiplication operations (Kametani: column 1, lines 45-49).

Per claims 2 and 24, Kametani teaches

- a difference between x and x_i (column 5, equation 3) is sufficiently small to achieve a desired accuracy of a final computation numerical value of said first polynomial p(x) ("series of polynomials" column 2, lines 5-10).

Per claims 8 and 30 Kametani teaches

- e) equating, via said machine-processing unit, a value of a highest ordered coefficient ("series of polynomials" column 2, lines 5-10) of said second polynomial c(x) to a value of an identified highest ordered coefficient of said first polynomial p(x) ("series of polynomials" column 2, lines 5-10) by generating a plurality of machine processing unit signals to determine: en., Pn; and

f) a value for each lower ordered coefficient of said second polynomial c(x) ("series of polynomials" column 2, lines 5-10) by generating a plurality of machine processing unit signals (control signals, column 3, lines 10-17) to determine: $Ck\_i = x_i \cdot C_k + P_k$ where k = (n-1) to 1.

Per claims 9,10 and 31,32 Kametani teaches

- Predetermined x_i is selected from a set of predetermined values ("series of polynomials" column 2, lines 5-10) of xi

- Predetermined x_i is closest member of said set of identified x ("series of polynomials" column 2, lines 5-10)

Per claims 41 and 42 Kametani teaches

- computer executable instructions ("instruction queue", column 3, 23-32)
- computer processing unit ("control unit" column 3, lines 11-58)
- binary representation (integration of logic gates, producing binary outputs, figures 6 and 7 operable with said computer processing unit ("control unit" column 3, lines 11-58)

Per claim 43 Bishop teaches

- mathematical software routine library (pg. 9, figure 1.7, SIMULINK Block Library)

Per claim 44 Bishop teaches

- software routine library (pg. 9, figure 1.7, SIMULINK Block Library)

(9c) Claims 11 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop in view of Kametani as applied to claims 1, 5, 23,27, and 30 above, and further in view of Gal et al., titled "An Accurate Elementary Mathematical Library for the IEEE Floating Point Standard."

Bishop as modified by Kametani teaches most of the instant application except for Homer's Rule to which Gal teaches.

Per claims 11 and 33, Gal teaches

- second polynomial c(x) is computed by using Homers Rule (pg. 31, 4^{th} line from the bottom of the page).

Therefore, at the time of invention it would have been obvious to one of ordinary skill in the art to modify Bishop in view of Kametani and in further view of Gal because Gal teaches a method, which controls the error, introduced by the computer representation of real numbers and extend the accuracy with actually using extended precision arithmetic (abstract).

(9d) Claims 5-7 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop in view of Kametani as applied to claims 1, 5, 14, 23,27, and 30 above, and further in view of Ito (US Patent 4,398,263; hereafter Ito)

Bishop as modified by Kametani teaches most of the instant application except for the recurrence expression (forward and backward) to which Ito teaches.

Per claims 5-7 and 27-29 Ito teaches

- recurrence expression (column 12, lines 7-11)
- forward and backward recurrence expression ("recurrence expressions" encompass all expressions, column 12, lines 7-11)

Therefore, at the time of invention it would have been obvious to one of ordinary skill in the art to modify Bishop in view of Kametani and in further view of Ito because Ito teaches a method of performing integrations of high precision with needlessly

prolonging the operational time (column 2, lines 24-27).

(9e) Claims 15-17,37-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop in view of Kametani as applied to claims 1, 5, 14, 23,27, and 30 above, and further in view of Cody, titled "Performance Evaluation of Programs for the Error and Complementary Error Functions."

Bishop as modified by Kametani teaches most of the instant application except for error and complementary error functions as well as Bessel functions to which Cody teaches.

Per claims 15-17,37-39 Cody teaches

- rational function r(x) is an approximation to an error function (ERF) (pg.30, line 1).
- rational function r(x) is an approximation to a complementary error function (ERFC) (pg.30, line 1).
- rational function is an approximation to a Bessel! function (pg. 37, reference 5)

Therefore, at the time of invention it would have been obvious to one of ordinary skill in the art to modify Bishop in view of Kametani and in further view of Cody because Cody teaches a method to test for estimating the accuracy of the function programs and some assessment of their robustness (pg. 29, lines 3-4).

(9f) Claims 18 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop in view of Kametani as applied to claims 1, 5, 14, 23,27, 30 and 36 above, and further in view of Ng, titled, "A Comparison of Computational Methods and Algorithms for the Complex Gamma Function." (hereafter Ng)

Bishop as modified by Kametani teaches most of the instant application except the log gamma function to which Ng teaches

Per claims 18 and 40, Ng teaches

- wherein said rational function r(x) is an approximation to a log gamma function (LGAMMA) (pg. 56, line 2)

Therefore, at the time of invention it would have been obvious to one of ordinary skill in the to modify Bishop in view of Kametani and in further view of Ng because Ng teaches a method which helps bring out a high quality algorithm to be recommended either for individual use or for inclusion in program libraries (pg. 56, Introduction, 2nd paragraph, lines 4-7).

(9g) Claims 12-14, 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop in view of Kametani as applied to claims 1, 5, 14, 23,27, and 30 above, and further in view of Hanselman et al., titled, "The Student Edition of MATLAB version 5 User's Guide." (hereafter Hanselman)

Bishop as modified by Kametani teaches most of the instant application except

denominator polynomials to which Hanselman teaches.

Per claims 12-14,34-36 Hanselman teaches

- a value of a denominator polynomial q(x) having identified ordered denominator coefficients, said denominator polynomial q(x) (pg.149, Rational Polynomials) being expressible as: q(x) = sum(Q_i˙ x') where j=0 to m, (pg.149, Rational Polynomials and pg. 315, summation of a series) h) determining, via said machine processing unit, a value of another polynomial d(x) having ordered denominator coefficients, (pg.149, Rational Polynomials) said another polynomial d(x) being expressible as: d(x) = sum (D_k • x^k) where k = 0 to (m-1)' (pg.149, Rational Polynomials and pg. 315, summation of a series) so that said denominator polynomial (pg.149, Rational Polynomials and pg. 315, summation of a series) q(x) is expressible as: q(x) = q(xi)+{x-xi} • d(x), and a value for the said denominator polynomial is resolved.
- the first polynomial (pg.149, Rational Polynomials) p(x) is a numerator polynomial p(x), (pg.149, Rational Polynomials and pg. 315, summation of a series) and p(x)-p(x_i) is computed, and p(x_i) is not read.

value of a rational function r(x) (pg.149, Rational Polynomials) being expressible as a quotient (multiplication, well known) of said numerator polynomial (pg.149, Rational Polynomials) p(x) and said denominator polynomial q(x) expressed as r(x) = p(x) / q(x), comprising further steps of: j) constructing, via said machine processing unit, a

value of said rational function (pg.149, Rational Polynomials) r(x) by generating a plurality of machine processing unit signals to determine: $r(x) = r(xi)\,'\,(I - (q(x)-q(xi))/q(x))) + (p(x) - p(xi))/q(x)$ (pg.149, Rational Polynomials).

Therefore, at the time of invention it would have been obvious to one of ordinary skill in the art to modify Bishop in view of Kametani and in further view of Hanselman because Hanselman teaches a method that assists anyone to solve many technical computing problems (pg. xvii, 3rd paragraph).

(10) Response to Argument

Appellants' summary of the prior art on pages 4 and 5 of the Brief is agreed with. However, appellants' statement regarding the greater precision than the inherent precision of the floating-point number system of the computer system is not considered to be found within the claimed invention. Furthermore, the issue to be considered for the rejection based upon 35 U. S. C. 101 is not whether the prior art discloses or makes obvious the claimed invention but whether the subject matter claimed is eligible for patenting.

Appellants have admitted that the invention is the solving of a polynomial, albeit at a greater degree of accuracy than has been previously known. Assuming for argument's sake that appellants' invention solves a polynomial to a greater precision than has been known before, the invention as claimed is still not considered to be directed to patent eligible subject matter. Simply put, solving a polynomial is still just solving a polynomial no matter what the degree of accuracy. As set forth in <u>Gottschalk v. Benson</u>, 175 USPQ 673, 675 (US 1972):

> "While a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be." ... "An idea of itself is not patentable."... "A principle, in the abstract, is a fundamental truth; an original cause; a motive; and these cannot be patented, as no one can claim in either of them an exclusive right." ... Phenomena of nature, though just discovered, mental processes, abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work. (Citations Omitted.)

The process of solving a polynomial is an abstract intellectual concept, no matter what the degree of precision. It is one of the basic tools of scientific and technological work and as such should not be the subject of a patent.

The examiner's citation of <u>In re Schrader</u> in the office action is withdrawn. However, it should be noted that it is not the Freeman-Walter-Abele test that is at issue here. It is whether the appellants are claiming an algorithm or not. Here there is no need for a two-part test to determine that appellants' are claiming an algorithm since by its very nature, the process of computing a polynomial is an algorithm.

Appellants' process of solving an algorithm is nothing more than an algorithm whether written as a process claim or an article claim. The defining point of the claimed invention is the algorithm and as stated in <u>Parker v. Flook</u>, 198 USPQ 193, 198 (US 1978)

> "He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end."(Citing <u>Funk Bros. Seed Co. v. Kalo Co</u>., 76 USPQ 280, 281).

Furthermore, appellants' claims are so broad as to include both known and unknown uses and thus preempt the field. Any claim that preempts the field is not eligible for patenting. See <u>Ex parte Lundgren</u>, 76 USPQ2d 1385, 1405 (Bd App & Int

2005), "A claim that covers ("preempts") any and every possible way that the steps can be performed is a disembodied "abstract idea" because it recites no particular implementation of the idea (even if one is disclosed)."

Appellants' argument concerning the credible utility of improving the precision of a floating-point number system in a computer is noted. It would be conceded that if appellants' claims are found not to be an abstract idea and that the claims do not preempt then they would have a credible utility.

As for appellants' claims directed to the machine, it is a machine of unspecified form that appellants are claiming. The sole differentiating feature is the algorithm. As was stated in Gottschalk v. Bennson at 676:

> The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that ... the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.

Preemption is preemption, whether by a method claim or an article claim.

Appellants' points with respect to the solving of rounding error are noted. As to appellants comments directed to the claims of an issued U.S. patent, this patent is not currently before this examiner. Any comments that might be made would be of a hypothetical nature and therefore must not be made.

2) The rejection of claims 1-4, 8-10,23-24,26,30-32 and 41-44 under 35 U.S.C. § 103 for obviousness based upon Bishop in view of Kametani

The Office has addressed all concerns as set forth in the previous office action. Appellants dispute of Kametani's teaching of claim 1, lines 3 and 4 of "reading, via machine processing unit, input data including a value for each identified ordered

coefficient of a first polynomial p(x) representing said property" are anticipated in column 2, lines 60-65 where, "...controlling the operation unit and the table memories by the micosequencer, the operation time is also reduced because the values of the coefficient functions can be read from the table memories during the execution of the operation". Coefficients associated with polynomials which, in this instance, are being processed inside a machine based processor (micosequencer).

Furthermore, computers or some machine based processors (Kametani: column 1, lines 19-23 "host processor" with figure 1; and column 1, lines 40-50 "...denotes an arithmetic and logic circuit which has functions of floating point addition/subtraction, format transformation...") require input from a user or some other device, thus rendering "input data including" inherent.

Appellants' dispute the Taylor series expansion (e.g., claim 1, lines 4-7) denoted in Kametani to which represent abstract representations of the polynomials set forth in appellants' invention. Specifically, the equations in claims 1 and 23, lines 4-7 and Kametani (column 4, lines 52-66) that are similar in their representation of the summation of multiplying two functions, with one function raised to a power. The functions of Kametani are an abstract representation with different coefficients that mirror the functional intent of the invention. The latter rebuttal is echoed for claims 1 and 23, lines 8-21 as anticipated by Kametani (column 4, line 68).

Appellants dispute the prior art limitations for claims 1 and 23, lines 22-26 denoting "outputting, via said machine-processing unit, said value of the first polynomial p(x) representing said property of the mathematically modeled physical system, wherein

said value of the first polynomial is outputted as a floating point number and the floating point number is a digital representation of an arbitrary real number in said machine processing unit". In this instance, the citations of Kametani in column 2, lines 5-10 and 30-40 denote a series of polynomials. Column 5, lines 15-30, lines 11-15 of Kametani denotes a_0 (X') and a_1 (X') as a polynomial series to which anyone can deduce the function of a_0 (X') is the first polynomial in the series. It would have been obvious to one of ordinary skill in the art at the time of invention to deduce the floating-point process (Kametani: column 2, lines 45-48), which encompasses various polynomials in order to extract a specific numerical output (Kemetani: abstract, lines 1-3 "...floating point operation for calculating an approximate solution"). Furthermore, appellants' arguments, to the merits of the claims relative to the prior art, only reaffirm the preemption argument, as stated above.

3) **The rejection of claims 5-7,11-18, 27-29 and 33-40 under 35 U.S.C. § 103**

Appellants' arguments with respect to claims 5-7,11-18, 27-29 and 33-40 are all of a similar substance and are summarized as being directed to the alleged deficiency of Kametani.

In response to appellants' arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Furthermore, appellants have not argued on the merits of the claims in question relative to the prior art.

Appellants' arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Tom Stevens

Tom Stevens

Conferees:

for

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